EARTH SC 4VV3  ENVIRONMENTAL GEOPHYSICS  Fall Term 2017

Instructor: Joe Boyce, GSB-232, x24188, email: boycej@mcmaster.ca
Lectures: Mon., Wed., 1:30-2:20 pm BSB 105
Field Demos/Labs: Wed., 8:30-11:20 am, BSB/331 GIS LAB (see schedule for dates)
TA: Tynan Pringle, email: pringlta@mcmaster.ca, x27524

Geophysical exploration methods are fundamental tools in the search for mineral resources but are also used widely in engineering, archaeology and environmental investigations to explore and image the shallow subsurface (< 200 m depth). A wide range of geophysical methods are now used routinely in the search for buried archaeological sites, characterization of groundwater resources, geological imaging of subsurface structures and stratigraphic studies.

**Course Objectives**
4VV3 provides an introduction to geophysical exploration methods with emphasis on techniques used to investigate the shallow subsurface (< 200 m depth). These methods include seismic reflection/refraction, ground-penetrating radar, electromagnetic, resistivity, gravity and magnetic methods. For each method, we will examine the underlying physical principles, the practical aspects of field data acquisition and signal processing and interpretation. Students will gain hands-on experience and skills operating geophysical instruments and collecting field data during field four field demonstrations.

**Marking Scheme**
- Labs (4 @ 10%) 40%
- Mid-term test 15%
- Final exam 45%

**Field Demonstrations**
We will be conducting four geophysical field experiments on campus (see schedule). During field demonstrations you will learn how to set-up and operate geophysical instruments and collect small data sets that we will process and interpret in the GIS Lab. **Attendance is required at all field demonstrations.** Field demonstrations are 2-3 hours in length and are held during your regular lab slot. Any changes in the field demo or lab schedule will be posted on A2L.

**Labs (GIS LAB BSB-331)**
On alternating weeks between field demonstrations we will meet in the GIS LAB (BSB-331) to work on lab assignments (see schedule). Assignments will include data processing and interpretation exercises designed to illustrate the material covered in lectures. You should bring a USB storage key (or other USB-compatible storage device) with you to the labs so that you can back-up and take your data with you. The GIS LAB will be available at other times during the week (times TBA) to allow completion of assignments outside of lab hours.

The software we will use in the labs includes state-of-the-art geophysical mapping and
processing packages that are used widely in industry (i.e. Geosoft Oasis, Kingdom Suite). The licensed software packages are for use only in BSB/331 and cannot be copied for individual use off site.

Course Textbook

Available as ebook through Thode library: http://catalogue.mcmaster.ca/catalogue/Record/2399938

Course Website
Course lecture slides will be posted periodically on Avenue to Learn.

Additional Reading Materials
Texts:

Journals:
- Journal of Engineering and Environmental Geophysics (JEEG)
- Applied Geophysics, Geophysics
- The Leading Edge

Academic Dishonesty
Academic dishonesty consists of misrepresentation by deception or by other fraudulent and can result in serious consequences, e.g. the grade of zero on an assignment, loss with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix located at: http://www.mcmaster.ca/senate/academic/ac_integrity.htm

The following illustrates only three forms of academic dishonesty: Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained. Improper collaboration in group work. Copying or using unauthorized aids tests and examinations. The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.


Lecture and Lab Schedule

The following is a general outline of the topics to be covered during lectures and lab periods. We may spend more or less time on some topics depending on progress.

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<tr>
<th>Week beginning</th>
<th>Lecture Topics</th>
<th>Field Demos and Labs</th>
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<tbody>
<tr>
<td>1) Sept 4</td>
<td>Course introduction</td>
<td>No field demo or labs</td>
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<td>2) Sept 11</td>
<td><strong>Seismic methods</strong>: Principles of seismic wave propagation, reflection/refraction, Snell’s Law</td>
<td>No field demo or labs</td>
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<td>3) Sept 18</td>
<td>Seismic reflection and refraction methods, data acquisition, interpretation</td>
<td>Field Demo #1: Seismic refraction experiment (Zone 7).</td>
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<td>4) Sept 25</td>
<td>Ground-penetrating radar (GPR), principles of electromagnetic wave propagation</td>
<td>Lab #1: Seismic refraction data interpretation (BSB/331)</td>
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<td>5) Oct 2</td>
<td>GPR instrumentation, field data acquisition,</td>
<td>Field Demo #2: GPR survey (East side BSB).</td>
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<td>6) Oct 9</td>
<td><strong>Midterm Recess – No classes</strong></td>
<td>No field demo or labs</td>
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<tr>
<td>7) Oct 16</td>
<td>GPR applications in geology, forensics, archaeology and engineering</td>
<td>Lab #2: GPR data processing and interpretation (BSB-331)</td>
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<td><strong>Mon. Oct. 16th – MID-TERM TEST (BSB 105)</strong></td>
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<td>8) Oct 23</td>
<td><strong>Gravity methods</strong>: gravity principles, gravity measurement</td>
<td>Field Demo #3: Gravity survey (Cootes Drive). Problem set #3</td>
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<td>9) Oct 30</td>
<td>Gravity corrections, data interpretation, case studies</td>
<td>Lab #3: Gravity data processing and interpretation (BSB-331)</td>
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<td>10) Nov 6</td>
<td><strong>Electromagnetics</strong>: time-and frequency domain EM methods, applications in archaeology and groundwater studies</td>
<td>Field Demo #4: Magnetic Survey (Zone 7) Problem set #4</td>
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<td>11) Nov 13</td>
<td><strong>Magnetic methods</strong>: principles of geomagnetism, rock magnetic properties</td>
<td>Lab #4 – Magnetic data processing (BSB-331)</td>
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<td>12) Nov 20</td>
<td>Magnetic field measurement, anomaly interpretation</td>
<td>No field demo or labs</td>
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<td>13) Nov 27</td>
<td><strong>Borehole geophysical methods</strong>: logging tools, field methods, interpretation</td>
<td>No field demo or labs</td>
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<tr>
<td>14) Dec 4</td>
<td>Review for final exam</td>
<td>No field demo or labs</td>
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Classes End Wed. Dec. 6
**POLICY ON ABSENCES AND MISSED WORK**

**McMaster Student Absence Forms (MSAF)**
If you miss a lab or test for a legitimate reason (e.g. illness or other extenuating circumstances) you must file documentation using the McMaster Student Absence Form (MSAF). The form and instructions are available online (https://pinjap01.mcmaster.ca/msaf/).

**Missed Work and Tests**
Submission of the MSAF form for a lab assignment or mid-term test will normally result in a one-week extension or rescheduling of your mid-term test. MSAF forms must be submitted within THREE working days of the submission date for the assignment or test. A grade of zero will be given for missing work or missed tests if no MSAF (or other documentation from the Associate Dean) has been received.

**Student Accessibility Services**
Students registered with Student Accessibility Services (SAS) and requiring accommodations must contact the instructor at the beginning of the term (preferably the first class) to discuss their needs and the nature of accommodations. Further instructions can be found on the SAS website (http://sas.mcmaster.ca/registering-with-sas.html).

**Late Work**
Labs or assignments submitted late will receive a penalty of 25% per day and will not be accepted more than two days beyond the deadline. Labs submitted after this time will automatically receive a grade of zero unless a MSAF has been filed. All late labs must be handed into the TA or placed in the 4VV3 drop box on the second floor of the General Science Building (GSB). Note: there is no access to the drop boxes after 4:30 p.m. or on weekends but there is an after-hours drop box on the second floor of GSB just inside the door on the west side of the building.

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